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Elective surgery after Covid-19: A narrative review of the literature

Cirugía electiva posterior a enfermedad por COVID-19: revisión narrativa de la literatura

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Abstract

By November 2021, at the time of preparing this article, the disease caused by the new coronavirus (Coronavirus Disease 2019 - COVID-19), declared as a pandemic by the World Health Organization (WHO) on March 11, 2020, had affected more than 128 million people and claimed upwards of 5 million lives. Many of the patients who suffered from this disease will need elective procedures, and this will require knowledge on how to perform the surgery, what tests to order and the extent of preoperative optimization. The objective of this work was to conduct a narrative review of the current evidence regarding time to the performance of an elective procedure in a patient who suffered from COVID-19, the preoperative tests that need to be ordered, and the degree of clinical optimization required according to the complexity of the surgery and individual patient clinical condition. A search was conducted in the Pubmed/Medline, Science Direct, OVID and SciELO databases, as well as in the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) web-based platforms. Although the evidence is still limited, different scientific societies have issued relevant guidelines pertaining to the timing of an elective procedure after COVID-19 infection. For patients who were asymptomatic, the time is 4 weeks after the initial diagnosis of SARS-CoV-2, whereas for symptomatic patients with a mild to moderate course, the time is at least 7 weeks, and 12 weeks if ICU admission was required. There are no guidelines pertaining to preoperative tests or the degree of clinical optimization, although institutional protocols have been developed based on expert consensus on the topic.

Keywords: COVID-19; Elective surgery procedures; Preoperative period; Diagnostic techniques and procedures; Anesthesiology.

Resumen

La enfermedad por el nuevo coronavirus COVID-19 (Coronavirus Disease 2019) declarada pandemia por la Organización Mundial de la Salud (OMS) el 11 de marzo de 2020, ha registrado más de 128 millones de casos a escala mundial, con más de cinco millones de muertes a noviembre de 2021, fecha de elaboración de este artículo. Muchos de los pacientes que tuvieron esta enfermedad se someterán a procedimientos electivos, y es necesario saber realizar la cirugía, los exámenes por solicitar y el grado de optimización preoperatoria. El objetivo de este trabajo es elaborar una revisión narrativa de la evidencia actual respecto al tiempo de realización de un procedimiento electivo en un paciente que tuvo COVID-19, los exámenes preoperatorios que se deben solicitar y el grado de optimización clínica según la complejidad de la cirugía y el estado clínico del paciente. Para ello, se realizó una búsqueda en bases de datos (Pubmed/Medline, Science Direct, OVID, SciELO), así como en plataformas web de la Organización Mundial de la Salud (OMS) y los Centers for Diseases Control and Prevention (CDC). Aunque la evidencia aún es limitada, diferentes sociedades científicas han dado pautas relevantes respecto al tiempo de realización de un procedimiento electivo despues de sufrir COVID-19. Para el caso de pacientes que fueron asintomáticos es de 4 semanas después del diagnóstico de infección por SARS-CoV-2, mientras que para pacientes sintomáticos con un curso de la enfermedad leve a moderado es de mínimo 7 semanas, y de 12 semanas si requirió ingreso a cuidados intensivos. No hay guías que orienten en cuanto a la solicitud de exámenes preoperatorios y el grado de optimización clínica, pero sí protocolos institucionales basados en consenso de expertos que abordan esta temática.

Palabras clave: COVID-19; Procedimientos quirúrgicos electivos; Periodo preoperatorio; Procedimientos y técnicas diagnósticas; Anestesiología.

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INTRODUCTION

On February 11, 2020, the international taxonomy committee gave the new coronavirus the name of Severe Acute Respiratory Syndrome Coronavirus type 2 (SARS-CoV2) (1). It is the etiologic agent responsible for COVID-19, the disease declared as a pandemic by the WHO on March 11, 2020, and which has caused more than 319 million cases and over 5 million deaths worldwide (2). Two coronavirus-related outbreaks had already occurred in this century, the first in 2002 caused by SARS-CoV and the second in 2012 caused by MERS-CoV (Middle East Respiratory Syndrome Coronavirus) (3-5).

With at least 28 million elective procedures postponed during the first three months of the COVID-19 pandemic, the number of patients who will be requiring surgery after suffering from the disease will grow rapidly. Due to the potential multi-system compromise caused by COVID-19, timing of an elective procedure must be carefully planned (6).

The objective of this article is to carry out a literature review on the topic of the adequate time to subject a patient who has had COVID-19 to an elective procedure, the preoperative tests and the degree of clinical optimization required according to the complexity of the procedure and the patient's clinical condition, with the aim of reducing perioperative risks.

PATHOPHYSIOLOGY OF COVID-19

SARS-CoV-2 replication starts when the virus binds to the epithelial cells of the respiratory tract, triggering an uncontrolled immune reaction aimed at containing the infection but which also explains damage to the healthy tissues (7-9).

There is a wide range of clinical manifestations. The most frequent symptoms include fever, fatigue, anorexia, headache, rash, diarrhea, myalgia, arthralgia and neurologic compromise. Tissue damage resulting from immune response imbalance may trigger coagulation disorders such as disseminated intravascular coagulation, thrombosis and consumption bleeding. The most commonly described complications are pulmonary, such as acute respiratory distress syndrome (ARDS) (10), followed by acute renal injury, liver injury, and inflammatory and functional cardiomyopathy (11). Tissue damage markers, which are also considered indicators of disease severity, include C reactive protein (CRP), elevated ferritin, D dimer, LDH, lymphopenia, anemia, thrombocytopenia, leukocytosis or leukopenia (12).

Among patients infected with SARS-CoV-2, 85% will have no symptoms or a mild form of the disease, 15% will need hospitalization due to moderate disease, 5% will require advanced oxygen therapy, and 1% will need critical care. Moreover, up to 5% of all patients will have residual symptoms for as long as 8 weeks or may even develop chronic symptoms associated with the primary SARS-CoV-2 infection.

POST-COVID-19 SYNDROME AND ASSOCIATED COMPLICATIONS

Patients with persistent COVID-19-related symptoms after the acute phase have been categorized under a clinical syndrome called Long COVID, which is divided into two main categories: subacute COVID and chronic COVID or post-COVID syndrome (13-14).

An important relationship has been found between the onset of long COVID and factors such as symptom intensity during the acute infection: need for intensive care unit (ICU) management with or without invasive mechanical ventilation; persistence of symptoms during the subacute or chronic phase; perception of diminished quality of life; and pulmonary function abnormalities (14). Other variables associated with this condition include prior pulmonary disease, high body mass index, advanced age, and belonging to a racial minority (14). However, it is clear that asymptomatic patients or patients with mild symptomatology are not exempt from developing this condition (15).

The countries with the most extensive published literature on this topic are China, the United States, France, Spain, Italy and the United Kingdom, since they were epicenters of contagion during the initial phase of the pandemic (16-20). One of the largest studies describing the long-term effects of COVID-19 was conducted in a cohort of 1733 patients in Wuhan, China (16). Using tools such as questionnaires, physical exam, 6-minute walk test, serum tests, pulmonary function tests in selected cases, and high resolution lung tomography, it described that 76% of the patients reported at least one long COVID-related symptom, the most frequent being fatigue and muscle weakness (63%), sleep disorders (26%), and anxiety/depression (23%).

Similar findings were reported in the study by Carfì et al. (20), which followed 143 patients during a 60-day period following acute SARS-CoV-2 infection. The study documented persistent symptoms in 87% of cases, including fatigue (53.1%), dyspnea (43.4%), joint pain (27.3%) and chest pain (21.7%); 55% of the patients continued to experience three or more symptoms, and 44.1% reported diminished quality of life.

WHEN TO TAKE A POST-COVID-19 PATIENT TO ELECTIVE SURGERY

According to the urgency of their indication, surgical procedures are classified as emergent, urgent, elective-urgent, essential elective, discretional elective or non-essential (21) (Table 1, Figure 1).

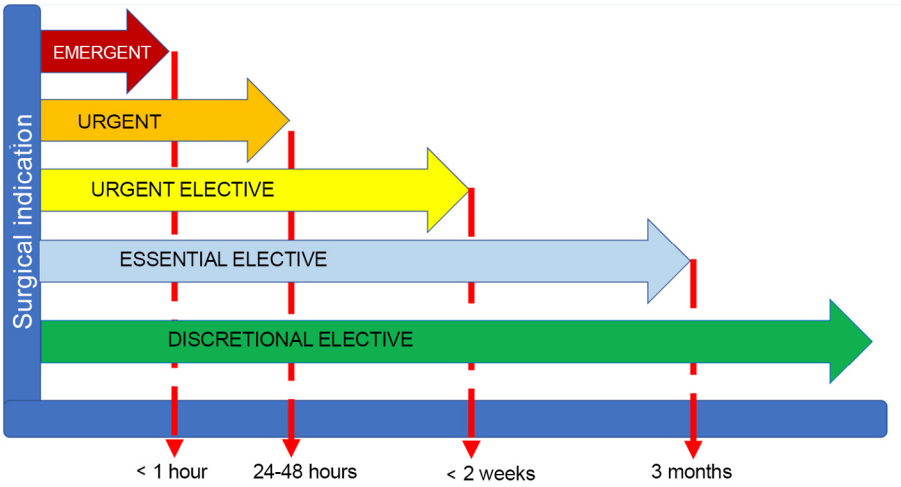
Elective surgery is defined as a surgical procedure for which there is time enough to adequately assess risk and benefits of the intervention and plan for the right timing (22). It is imperative to understand that elective surgery is not the same as optional surgery, but rather a procedure which does not need to be performed in response to a life-threatening situation; however, it has to be borne in mind that postponing or cancelling an elective surgery

Table 1. Types of surgeries according to the urgency of the procedure.

Surgery	Definition	Examples
Emergent surgery	Cannot be postponed for more than 1 hour after it is scheduled	Trauma in unstable patient Cardiac tamponade Acute occlusive vascular injury
Urgent surgery	Must be carried out within 24 and 48 hours	Acute appendicitis Acute cholecystitis Open fractures
Elective/urgent surgery	Must be carried out within less than 14 days	Cerebral aneurysm repair Elective cesarean section Closed fractures
Essential elective surgery	Can be postponed for more than 14 days but less than 3 months	Oncologic surgery Hernia repair Reconstructive surgery
Discretional elective surgery	Can be performed 3 months after it is scheduled	Plastic surgery Bariatric surgery Joint replacements

Source: Autores.

Figure 1. Types of surgeries according to the urgency of the procedure.



Source: Autores.

Table 2. COVID-19 classification.

Classification	Definition
Acute COVID-19	COVID-19 signs and symptoms that manifest for up to 4 weeks after the onset of the clinical picture
Ongoing subacute or symptomatic COVID-19	Patients who continue to exhibit symptoms between 4 and 12 weeks after the acute infection
Post-COVID-19 syndrome or chronic COVID-19	Includes patients with persistent signs and symptoms beyond 12 weeks after the onset of acute COVID which are not attributable to other diagnoses
Resolved COVID-19	Complete resolution of COVID-19 signs and symptoms

Source: Autores.

could potentially give rise to significant complications in 50% of cases (23).

The following considerations must be taken into account during the preoperative assessment of patients who have recovered from COVID-19 and are scheduled for an elective surgical procedure: severity of the initial clinical picture, persistent symptoms, comorbidity, clinical priority, fitness before and after the infection, risk of disease progression, and complexity of the surgery (6,24).

Apart from the above, the anesthetist must be familiar with the clinical phases of COVID-19: ongoing or symptomatic disease, post-COVID-19 syndrome or chronic COVID-19, and resolved COVID-19. Tools such as the clinical severity scale for this condition can be introduced as part of the assessment, in order to classify the disease as asymptomatic or mild, moderate, or severe, thus providing support for decision-making regarding the management approach in each case (Tables 2 and 3) (6,13).

It is important to stress that even if patients who have recovered from COVID-19 have persistent symptoms involving multiple systems, it is those patients with cardiopulmonary compromise who have most commonly been found to have adverse perioperative outcomes. The incidence of potentially lethal complications in these patients is as high as 50%, with 30-day mortality of 19.1% in elective surgery, and 26.0% in urgent surgery (25). The risk is higher in male patients, over 70 years of age, American Society of Anesthesiologists (ASA) classification 3 to 5, with underlying malignant neoplasm, or urgent or major surgery (26).

Several initiatives aimed at tackling this problem emerged during the pandemic. One example is the COVIDSurg Collaborative (27) which conducted a multi-center, prospective cohort study with 140,231 patients taken to elective and urgent surgery during the pandemic; of these, 3,127 (2.2%) had a preoperative diagnosis of SARS-CoV-2. Thirty-day

Table 3. COVID-19 clinical severity.

Classification	Definition
Outpatient	Mild disease or asymptomatic patient
Hospitalized	Moderate disease: with oxygen supplementation (using conventional cannula or face mask) or without oxygen supplementation
	Severe disease: **a.** Hospitalized with non-invasive mechanical ventilation or high flow nasal cannula **b.** Intubation and mechanical ventilation: PaO2/FiO2 > or = 150 SO2/FiO2 = 200 **c.** Mechanical ventilation PaO2/FiO2 < 150 or SO2/FiO2 < 200, or vasopressors. **d.** Mechanical ventilation PaO2/FiO2 < 150 or SO2/FiO2 < 200, and vasopressors, dialysis or ECMO.

FiO_2: Fraction of inspired oxygen; PaO_2: Arterial oxygen pressure; SO_2: Oxygen saturation.
Source: Autores.

mortality in patients with no SARS-CoV-2 was 1.4% (95% CI [1.4-1.5]). In patients with a prior diagnosis of SARS-CoV-2 infection, an inverse correlation was observed between the time to surgery after COVID-19 and 30-day mortality, which was 9.1% within the first 2 weeks, 6.9% for patients intervened after 3 to 4 weeks, 5.5% for patients taken to surgery within 5 to 6 weeks, and 2% after 7 weeks. In this last group, mortality was higher among patients with persistent symptoms than in patients whose symptoms had resolved or who had remained asymptomatic during the acute phase of the infection. Similar findings were reported by Jonker et al. (28), who described a 30-day mortality of 4% for the group with no COVID-19 diagnosis as compared to 16% in patients with perioperative SARS-CoV-2 infection, for whom higher rates of pulmonary and thromboembolic complications were also described. Finally, in their cohort study, Doglietto et al. (29) reported higher mortality and greater surgical complications in patients with COVID-19 when compared to patients who did not have the infection.

These findings can be readily explained given that, from the cardiovascular perspective, studies have shown that 60% to 78% of patients with SARS-CoV-2 infection exhibit inflammatory changes on cardiac magnetic resonance imaging, which can manifest in the form of left ventricular dysfunction and arrhythmias, among others (30). In patients with risk factors for cerebrovascular disease and advanced age taken to surgical procedures, different types of complications are observed more frequently, including prolonged hospital stay, slow recovery, multiple sequelae, and even death. Moreover, it has been found that SARS-COV-2 infection is a risk factor for pulmonary and venous thromboembolism, with an incidence of 6.6% and as high as 18.9% in critically ill patients (26) who are considered to be at high risk for perioperative thromboembolism.

Added to the above, multiple anesthesia and surgical societies worldwide (6,24) have recommended not to schedule elective surgery during the time that the patient can transmit the infection. The Centers for Disease Control and Prevention (CDC) published their guidelines for extending isolation precautions 10 days following the onset of symptoms in cases of mild to moderate disease, and 15-20 days in cases of severe disease, provided no fever is documented for 24 hours without the use of antipyretics and there is evidence of reduced symptoms like cough or dyspnea (31). In 95% of critically ill patients who are highly immunocompromised, virus with the ability to replicate has not ben documented beyond 15 days after the onset of symptoms (32). For patients who are receiving immunosuppressants such as dexamethasone 6 mg/day (equivalent of 40 mg of prednisolone) for 10 days and/or monoclonal antibodies, the opinion of the infectious disease specialist is required.

Bearing all of the above in mind, some authors suggest that asymptomatic COVID-19 patients can be taken to the surgical procedure 4 weeks after being diagnosed. In contrast, patients who were symptomatic during the acute phase of the infection should not be taken to any elective procedure within the first seven weeks after the diagnosis, unless the risk of postponing surgery outweighs the risk of COVID-19-related postoperative morbidity and mortality (6). In patients who were critically ill and required ICU admission, the recommendation is to perform this type of intervention once 12 weeks after the diagnosis have elapsed (24). However, these recommendations do not eliminate the need for specialized and personalized assessment, as well as multidisciplinary perioperative management for each individual patient.

Other factors that must be taken into account when deciding to take a patient to surgery include availability of hospital resources, sufficient healthcare human talent and personal protective equipment needed for safe care. Different societies (33,34) have published scores or scales to help guide the medical team regarding the relevance of performing a surgical procedure. One example is the MENTS (Medically Necessary, Time-sensitive Procedures) score suggested by the American College of Surgery (33). Preoperative assessment should include time since clinical recovery from COVID-19, frailty status, fitness, and return to pre-COVID-19 baseline condition. In certain cases, multidisciplinary rehabilitation or prehabilitation must be performed (35).

PREOPERATIVE TESTING IN POST-COVID-19 PATIENTS

The aim of the preoperative assessment is to determine the patient's clinical condition and, if needed, optimize it before the surgery. There are no clinical practice guidelines to this date that can guide the preoperative assessment and the preoperative tests required for patients who have suffered from COVID-19 and need an elective procedure. In Oregon, United States, a multidisciplinary team consisting of anesthesia and surgery leaders (35) working in a hospital setting developed a protocol for preoperative assessment and selection of laboratory tests for post-COVID-19 patients. This protocol stratifies patients according to the type of surgical procedure (major or minor surgery) and clinical condition at the time of surgery (asymptomatic or symptomatic). In all cases, the suggestion is to ask for an electrocardiogram, complete metabolic panel including lactate, and complete blood count. For symptomatic patients who will be taken to minor surgery and for all patients scheduled for major surgery they suggest ordering D dimer and natriuretic peptides (BNP and NT-PRO-BNP). In the event the latter is outside normal limits and the clinical exam suggests cardiovascular decline, the assessment should be expanded to include an echocardiogram. Coagulation times, fibrinogen and a chest X-ray must be ordered for all patients undergoing major surgery, regardless of their clinical condition. Finally, pulmonary function tests are suggested in patients who had a severe course of CODIVD-19, in case they need major surgery. Other tests such as prealbumin, lactic dehydrogenase and ferritin are left up to the surgical team, depending on disease severity.

The results of a survey conducted among 154 anesthetists with the aim of gathering the opinions and practices of these professionals in their daily practice with patients who suffered COVID-19 and needed elective surgery were published in May 2021 in the Indian Surgical Oncology Journal (36). Most of the respondents concluded that it is important to optimize the management of comorbidities and reassess fitness before a surgical procedure. They also pointed to the need of performing chest X-ray, electrocardiogram and coagulation profile in all recovered patients. Regarding lung function tests, they agreed that blood gases, pulmonary high-resolution computed axial tomography (HRCT) or lung function tests must be performed in patients who had moderate-to-severe hypoxemia or significant cardiac symptoms during COVID-19, and also in patients scheduled for major abdominal vascular, cardiac or thoracic surgery and in elderly patients. As for cardiac function assessment, they suggest ordering troponin I as well as an echocardiogram if the patient had significant cardiac symptoms or in patients undergoing major abdominal, vascular, cardiac or thoracic surgery. Only 1.9% of the respondents suggested using NT-PRO-BNP.

In terms of diagnostic testing for COVID-19 in the perioperative setting, Reverse Transcription-Polymerase Chain Reaction (RT-PCR) positivity is not correlated with live virus shedding and, therefore, assessing infectivity risk within the three months following diagnosis has little or no value. Beyond that time, the test should be performed before surgery in order to avoid the postoperative complications and mortality that have been described as significant in patients with acute concurrent infection with this virus (37,38). Another aim of preoperative diagnosis is to preserve the safety of the surgical team. This has been a controversial topic due to the lack of publications with high-quality evidence to this date. The urgency of the condition, the local resources and the potential outcomes in case of postponing the surgery must all be part of the decision.

CONCLUSIONS

Although evidence is still limited, different scientific societies have issued recommendations regarding adequate timing for elective surgery. For patients who were asymptomatic, the time interval is four weeks after the diagnosis of SARS-CoV-2 infection, while for symptomatic patients with mild to moderate disease course, the interval is al least seven weeks, and twelve weeks if ICU admission was required. Although there are no guidelines regarding which preoperative tests should be ordered, there are institutional protocols based on expert consensus that can guide the treating surgical team in this setting. Despite the fact that these guidelines are useful in our practice, they should not take the place of personalized assessment as the starting point for decision-making. More robust studies that approach this topic are required.

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Authors' contributions

LZC, JAPJ, JSCG and AVD: Planning of the study, search of the literature and initial and final drafting of the manuscript.

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Conflict of interest

The authors declare having no conflict of interest.

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